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REVIEWS

Comparison of North American and European Glacial Deposits. By FRANK LEVERETT, Ann Arbor, Mich. *Zeits. f. Gletscherkunde* (1910), IV, 241–316; Pls. V.

Intercontinental comparisons of this class may be made from the viewpoint of an individual worker, or from that of a representative of a special class of workers, or from that of an analyst of the whole body of current conceptions. Each viewpoint has its appropriate place and value, and each comparison must be adjudged on its own basis. The comparison of Mr. Leverett is individual rather than representative or composite. This gives occasion to note the reach of the personal studies that form the basis of the author's perspective. No one is more intimately conversant with the later glacial deposits of the plains of the United States from the Alleghenies to the Mississippi than is the author of this comparison. With the equivalent deposits east of the Appalachians, west of the Mississippi, and north of the national boundary, the author's familiarity comes rather from occasional excursions and secondary sources than from personal studies. With the older Labradorean formations east of the Mississippi the author's familiarity is also intensive, and this intimate knowledge extends measurably to the tract closely bordering the Mississippi on the west, but not in equal degree to the formations of the Missouri basin, to the glacio-fluvial deposits of the Lower Mississippi valley, or to those of the Atlantic coast. The montane field of western America lies outside the author's individual purview.

To this intensive basis in American study, Mr. Leverett has recently added a year's inspection of the European formations, with Berlin as a working center and German interpretations as a point of departure. His field studies lay chiefly in the German lowlands and in the Alps, with a very cursory glance at the British field.

These salient features of the author's experience may serve to orient the psychologic plane from which the comparison is made and to foreshadow the selection, emphasis, and coloration which might naturally arise from the author's point of view.

In full harmony with these, the preliminary glance over the makeup of the paper brings at once to view the obvious fruits of the intensive habit.

These constitute a notable part—and, it will be agreed, a most valuable part—of the paper. As by instinct, here and there the author drops into details of location and measurement, and the text takes shape more as a record of local facts than as a generalized intercontinental comparison, as on pp. 266–73, where the successive paragraphs are headed, "Basel," "Eglisau," "Leutkirch," "Drau Valley," "Lake Garda," "Cantù, Italy," "Dora Baltea," "Rivoli," and "Bièvre-Valloire"; with similar local treatment on pp. 283–95, and elsewhere. Besides contributing such local observations from the viewpoint of an American glacialist, the author earns our thanks by giving a convenient map of the limits of "The Old Drift," "The Middle Drift," and "The Young Drift" of the German lowland, to the construction of which he himself appears to have made local contributions.

The comparison itself is introduced under the head of "The Oldest Drift." America here makes its bow under an apology, as it were, for the buried state of the oldest drift in the Keewatin field and the scanty, scattered, weathered, remnant nature of the Jerseyan drift. But in reality these ragged weathered remnants tell the very story of age that most becomes a venerable drift. It is hard to pass complacently over so light a treatment of the worn and aged Jerseyan formation. To put the still more scant remnants of the old drift of the Allegheny Valley in their place as more representative but emphasizes the personal viewpoint which runs through the whole comparison and gives it at once its values and its limitations.

In assembling the group of oldest glacial deposits of the two continents, the old drift of the Allegheny basin (with some reservation), the Jerseyan east of the Alleghenies, and the pre-Kansan of the Mississippi Valley, as the American correlatives, are matched with the Scanian of north Germany, the Günz of the Alps, and the older Deckenschotter of the Alpine foreland. The oldest Deckenschotter however has a better correlative in the oldest member of the Columbian group, bordering the Jerseyan drift, both being outwash aprons, and in the massive Natchez formation of the Mississippi outwash train, and better still—because of similar topographic relations—in the remnants of old outwash sheets that spread forth from the ancient glaciers of the Uinta, Wasatch, and other montane centers of the Cordilleras, which are unmentioned. It would be ungracious to lay stress on this, did not the American side of the comparison, and withal the rounder and truer view, suffer from the neglect of some of America's most significant formations even when they have been fairly well worked. It may be noted also that the Günz drift has its best American correlatives in the Cordilleras.

For the first interglacial series, the Aftonian of America is compared with the Paludinenbank of Germany, the Norfolkian of England, and the Günz-Mindel interglacial beds of the Alpine region.

As the second glacial series, the Kansan of the Keewatin field, and, questionably, the old deposits of the Allegheny Valley as a doubtful representative of the Labradorean field, are brought into comparison with the Lower Diluvium of the German lowlands, the Old Drift of England, the Mindel of the Alps, and the younger Deckenschotter as the associated outwash deposit of the last. The American correlatives of the last, in kind, are passed over.

The representatives of the second interglacial stage are the Yarmouth and the pre-Illinoian loess, on the American side, the Rixdorf of north Germany, unnamed beds in central Russia, and the Mindel-Riss interglacial deposits of the Alps, on the European side.

As representatives of the third glacial stage, the Illinoian of the Labrador field and doubtfully the "so-called Iowan of the Keewatin field (Illinoian ?)" are put into correlation with the Middle Drift of the north German lowland and the Riss drift of the Alps.

The third interglacial stage brings into comparison the Sangamon soil of the Labradorean field (no equivalent in kind in the Keewatin field) with the Riss-Würm interglacial deposits of the Alps. The main loess deposits of both the American and the European fields are discussed in this connection and made largely interglacial and eolian.

Only four glacial stages are recognized and the comparison ends with the fourth group, which embraces the Wisconsin series of America, the Upper Diluvium of north Germany, the Young Drift of England, and the Würm beds, with the associated Niederterrassen of the Alpine region. The glaciation of the Riesengebirge and the Schwarzwald are also touched on in this connection.

In the summary, some qualifications of the correlations are introduced, the most notable of which is the statement that "the European deposits seem to contain nothing that correlates clearly with the Illinoian drift." The middle drift of north Germany and the Riss, "though standing as representatives of the third glacial stage in their respective regions, each seems to be younger than the Illinoian drift."

It is in the grouping of this third stage and in the treatment of the Iowan that there is likely to be awakened the strongest dissent from the comparison of Mr. Leverett if it be considered—as it is liable to be considered—a representative rather than an individual correlation. It is important, the rather, to note that in the author's own point of view, the third stage, the Middle Drift, presents the most notable anomalies. There is little doubt that most American glacialists will agree, each in his own way, that the interpretations of the middle drift of America, if we may use the term rather broadly, are those that most invite question and perhaps further readjustment. And so a few of the salient features of the shifting history of American opinion on the middle drift may be pertinent to this review. By American middle drift let us understand the formations that lie between the Aftonian interglacial beds that cap the lowest till and the base of the declared glacial sheets of Wisconsin age.

In an early comparison of American and European glacial formations put in print sixteen years ago in the revised edition of Geikie's *Great Ice Age* (1894, p. 774), the American deposits were given a threefold grouping, with a basal member, the Kansan, a middle member, the Iowan, and an upper member, the Wisconsin, using here the simplified forms the terms subsequently took. The first, the Kansan, was made to embrace the till below the "Forest Beds" and the "Noah's Barn-Yards" that were then supposed to form a common interglacial horizon; the second, the Iowan, was made to include the till above the "Forest Beds" and below the young moraine-ridged sheet which was made to constitute the third or upper division, the Wisconsin. This last division has held its place and name with firmness throughout and shows no signs of instability, but the two earlier divisions have suffered a serious shifting of names and of interpretations, and the end is perhaps not yet at hand. The name Kansan has been shifted from the sub-Aftonian till to the super-Aftonian till originally called Iowan. The term Iowan thus displaced has been transferred from the middle drift to the uppermost and least member of the grouped beds originally covered by the term. The reasons for these shifts seemed cogent to the workers in the Iowan field at the time they were made and perhaps seem so still. They were accepted with slight reluctance by the glacialist who had given the terms their original applications. The cogency of the reasons for the changes has, however, from his point of view, largely disappeared with the progress of study, and if it were practicable to return essentially to the original usage, making the sub-Aftonian till Kansan and the super-Aftonian till Iowan, and to take the exceptional exposures of both formations near Afton Junction, Iowa, as the types, as was originally done, it would seem to him to accord best with the inherent fitness of the case. Particularly does this seem so in the application of the term Iowan, for the super-Aftonian till not only has a broader and more distinctive expression in Iowa that anywhere else, but it is the greatest of Iowa's drifts; it is inherently the Iowan drift. When the shift of terms was made, it was supposed that the uppermost till sheet in eastern Iowa with its peculiar youthful typography, accidented by remarkable granite bowlders, set superficially, embraced all the upper drift down to the "Forest Bed," in other words all of "the Upper Till" of McGee's classical paper on the drift of northeastern Iowa. As this upper till of McGee was the type of the East Iowan (Geikie's *Great Ice Age*, 760–62), the name naturally followed the new interpretation. The youthfulness of the surface and the freshness of the bowlders of this uppermost formation seemed to force its separation from the well-eroded deeply-weathered sheet which overlies the Aftonian beds at their typical locality. It has since been found, however, that the fresher features of the Iowan belong only to a thin superficial formation, and it will probably now be agreed by most experienced workers familiar with the region that the main part of McGee's upper till is to be correlated with the super-Aftonian till at the typical locality, thus restoring, in large measure, the original applicability of the term.

This sketch, even in its incompleteness, may serve to give a measure of historic insight into the embarrassments that attend the correlation and nomenclature of the American middle drift.

Respecting the newer divergencies of opinion implied in Mr. Leverett's paper, which involve the suggested dismissal of the Iowan altogether, as a distinct formation, or else its grouping under the Illinoian, it is appropriate here to urge restraint, patience, and equipoise, for the distinguishing phenomena, while pronounced and peculiar, are subtle in their gradations and singularly puzzling.

T. C. C.

The Middle Devonian of Ohio. By CLINTON R. STAUFFER. Geological Survey of Ohio, 4th Ser., Bulletin No. 10. Pp. viii+204, 17 plates. Columbus (1909), 1910.

The first chapter of this bulletin is devoted to a "General Discussion of the Middle Devonian," which is considered under three headings. The first part is a "Historical Sketch" in which the literature of the Middle Devonian formations is carefully and fully reviewed. This is followed by a consideration of "The Middle Devonian in Adjoining Territory," in which the greatest amount of space is given to the equivalent formations of Indiana and Michigan, which have also been studied by the author in the field. In the closing part of the chapter is a "General Description of the Middle Devonian" formations, which in Ohio are the Columbus and Delaware limestones and the Olentangy shale. The Middle Devonian